CHAPTER 4

TANKS, FITTINGS, AND AIR LINES

An air suspension setup requires many components, and it's easy to give some of them more or less thought than others. After all, you'll probably sweat the details when it comes time to pick a compressor, but what fittings do you need? Who cares, right?

Well, you should care. Although these are the types of things that are often overlooked, they're critical to your setup. Without the right fittings, you'll have reliability issues. Without the right tank (or tanks), you'll run out of air frequently or find your compressor(s) running constantly trying to fill them. Also, the right air line makes the difference between finding yourself on the side of the road and not.

This is important stuff, so take the time to do it right.

Two air tanks sit in the bed of this Ford F-150, and they're enough to get the job done.

Tanks

Pop the trunk or look at the chassis on any airbagged vehicle, and you'll find an air tank of some kind. Sometimes it's an oval tube, other times it's the frame itself. Some method for holding air in the system is needed. Otherwise, you won't be able to lift the vehicle.

Airbags take pressure to inflate, and you can't get that from a compressor pushing air by itself. The air needs to be compressed, and the only way to do that is through some method of storage. That's your air tank.

Think of it like your car's battery. Sitting there by itself, it has 12 to 14 volts of power ready to use. When you turn the key (or push the button on your fancy newer ride), the starter motor draws power from the battery, draining it in the process. As you drive, other systems demand electrical power, and they call upon the battery to keep them running. What fills the battery back up? The alternator. It's constantly generating the power that the battery needs, and the cycle continues.

If the analogy is taken further, the battery is like an air tank and the alternator is like an air compressor.

The compressor fills the tank, and the tank is constantly called upon for air.

Now, the tricky part when selecting a tank is figuring out how much capacity you need. Tanks are typically measured in gallons (1, 3, 5, etc.), and since they come in many shapes and dimensions, you have many options. How do you know what the right size is for you? Good question. Let's find out.

In this situation, two identical tanks were combined with a 1/2-inch straight-pipe nipple, which effectively doubled the overall storage. Not all tanks are built alike, so consider using tubing and PTC fittings if necessary.

Tank Selection

The first item to consider is the size and weight of your vehicle. If you're putting airbags on a 1995 Honda Civic, you're not dealing with a lot of weight. It won't take a lot of pressure to inflate those bags, either. However, if you have a crew cab Ford F-350 dually and you plan on using it to tow, then there are other concerns. Will you have enough capacity? Do you want to run air tools off the system? What are your needs?

Those are a lot of questions to answer, but fortunately, you have options. Tanks come in a wide variety of sizes, so when in doubt, start small and expand later. Begin with a 3- or 5-gallon tank and then add another if necessary. All you need to do is run a new line to connect the two, and you're golden.

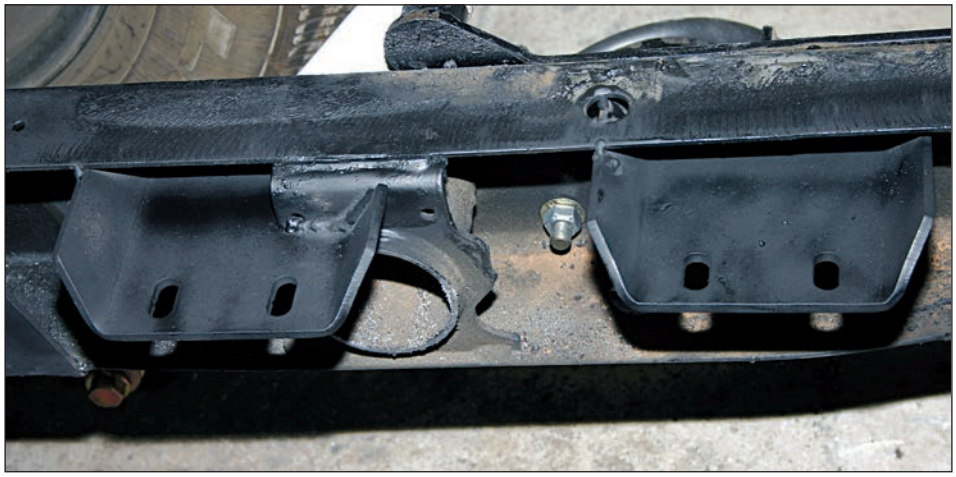
It brings up another obvious question: where do you put the air tank(s)? That's another aspect that factors into the size decision. On most passenger cars, the obvious spot is the trunk. You can usually put a 5-gallon tank mounted parallel to the axles in the back and then have room for compressors on the sides. Otherwise, if you want to remove the spare tire, you can sometimes get a 3-gallon tank in there depending on the available space.

Trucks and body-on-frame cars have a whole other series of options. With trucks, the obvious location is the bed. However, because many people build their trucks with the bed off, they end up putting the tank(s) either in the spot for the original spare tire or somewhere else on the frame. Creative locations include the side of the frame under the cab, or way back by the bumper. If your truck's bodystyle came with optional dual gas tanks but is only equipped with one, put a tank or two in the remaining spot. There are many options.

Unibody cars are different. They don't have the same kind of frame to work with, so often you're left with putting the tank(s) either in the trunk or making modifications to the body so the tank(s) can sit underneath. For example, some people take out their spare tire and put their air tank in that void, while others cut out the factory spare tire well entirely, weld in a plate, and then bolt the tanks to the underside of the car in that spot. Again, it's up to you.

You have to think about the quantity of tanks you want and where you could put them. Then, decide what works with your budget and go from there. A good starting point is a single 5-gallon tank, but remember, you can always add more later. That's one of the benefits to airbags, so don't forget about it.

There's one other item to consider, and that's the length of your air line runs. The line that goes from the valve to the tank is additional



The tanks used in this setup had optional mounts to weld in place. These allow you to bolt the tanks in and remove them just as easily if necessary.

volume that you'll have to fill every time you hit the switch. If you have a Ford Focus, that's no big deal. However, put that on a crew cab Dodge dually, and you could have an additional 20 feet to work with. If you have any concerns, you can always add another tank.

Ports and Locations

Another thing to think about with your tank choice is the amount and size of the ports. There is more information about this later in this book, but the speed of your system is limited by the smallest port. So, if you want to lift the vehicle fast, 1/2-inch lines and valves make a lot of sense. However, if you have the valves connected to the tank with 1/4-inch lines, you're putting a kink in the system. If anything, you want to go in reverse: bigger ports on the tank and smaller on the valves. Then, you'll never choke anything out.

Also, consider the number of ports. If you're running a valve manifold, you need one line to fill it that runs from the tank. You'll also have a pressure switch, drain port, and at least one compressor that goes in the tank as well, which gives you a minimum of four ports. If you're doing individual valves located closer to the airbags, you have another four ports to add on. More compressors add to the list as well.

Then, there's *where* those ports are located. There can be a drain port, and it should be on the bottom to let gravity work. The rest of the fittings and their placement comes down to where you put the remainder of the system. Some people like to hide their air lines. If they mount the tank in the trunk of a car, they put the lines so that they run toward the front and therefore away from the viewer. Other people run ornate hard lines, and they put their ports on the opposite side to show off their work. It comes down to personal preference and your particular setup's requirements.

Tank Material

Consider what the tank is made from. It seems like a silly detail, but it's pretty important in the grand scheme of things mainly because of water.

As previously mentioned, moisture builds up during the air-compression process, and it will sit in the bottom of the tank. Some tanks (typically cheaply made ones) are built with steel, and steel rusts. Better ones are aluminum, but since aluminum is a softer metal than some of the fittings, you could strip out the tank. Then, there's stainless steel, which is also rustproof and, like aluminum, can polish up nicely.

Realistically, it takes years for the inside of a steel air tank to rust. However, since these are one of those "set it and forget it" type of things, it's best to start with a firm foundation.

Another relatively new option is a tank that uses composite materials. For example, The Original Square-Tank has a composite tank that is flanked by two billet aluminum end caps. If you're looking for something that won't rust and will stand out in a crowd, consider something similar that's made with a different type of material entirely.

Water Traps

There's one other aspect to consider with the overall tank setup: a water trap. If you live in an area with lots of humidity or where the temperature dips into the freezing range, consider getting one.

A water trap, well, traps water. It seems obvious, and you've probably seen them in commercial air

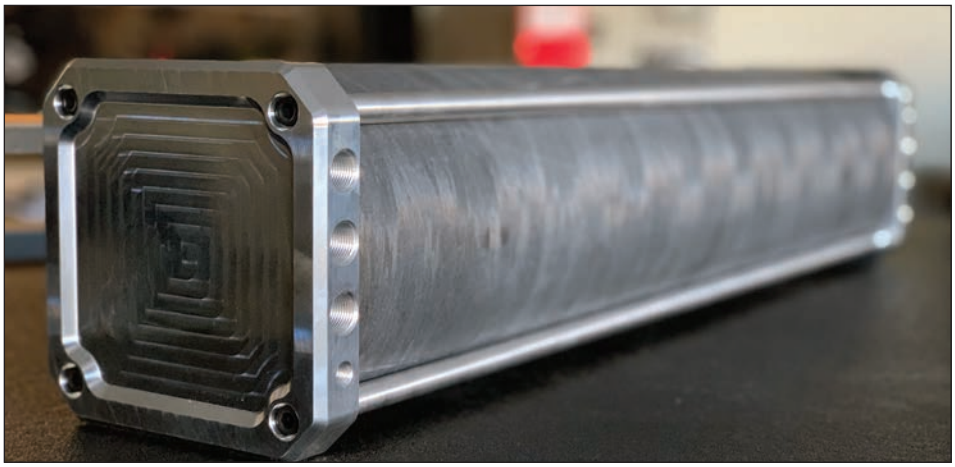
Draining Your Tank

An aspect that a lot of people don't consider is that their air tank will build up moisture internally. Since most tanks are made from steel or some variation, over time, that condensation causes it to rot from the inside out, eventually forming leaks. That's when you need to replace the tank entirely.

The fix is to regularly drain the tank. You can do that with something as simple as a draincock mounted to the bottom. Just open it up, let the air pressure push the water out, and you're good.

The problem is that some people have their tanks inside their trunks, and rusty water can make a mess. In that case, an option is to run a single valve right off the bottom of the tank. Take an air line, route it outside the trunk, and then connect it to the valve. When you want to empty the tank, just trigger the valve, and it'll release the air outside of the vehicle. No more mess.

Yes, there's the added cost of adding a valve to your system and the time it takes to wire it. However, in the end, you'll remove the friction point that usually comes with draining a tank (for example, crawling under the car and opening a ball valve) and make it easy. That alone is worth it.



This is The Original SquareTank, and it has a composite center portion. It's sandwiched by two aluminum end caps that have NPT ports built in. (Photo Courtesy Switch Suspension)

compressor situations. They're not very common with modern airbag setups though, and that's because they're not strictly necessary. Just like a traditional water trap on the air compressor you may have in your shop or garage, it stops water from getting to the object you have plugged in at the end of the line. In this case, it'll be your valves and airbags.

If you don't run a water trap, you risk having problems, particularly if you're in one of those previously mentioned humid or cold climates. Valves can stick over time by getting gunked up with corrosion, as can your fittings (assuming they're steel). Basically, a water trap is another line of defense in the whole process.

So, where do you put one? Well, it depends on how your setup is designed. Ideally, it goes between the line from your tank to the valves. However, you may have four banks of valves, and that would necessitate four water traps, which seems like overkill. If you're running a manifold, you'll have one feed line for sure, and that could hold your water trap.

Another item to note: keep the water trap low if possible. Gravity causes water to run to the lowest point, so having it down there will help.

Compressed Gas

If you want to build a hopper (a vehicle designed to launch the front or rear tires off the ground with the power of the airbags), you need to get as much pressure out of the tank as fast as possible. To do so, consider a compressed gas tank.

You can get a tank filled with a compressed gas (nitrogen being the most popular option) and a pressure regulator to establish how much pressure is in the system. You still have valves and lines, but now everything is usually much bigger and beefier (3/4- and 1-inch hydraulic lines and valves, typically) so that you can accommodate the pressure you're putting into the system. Your airbags have similarly sized ports.

The idea is that you're replacing the "slow" air compressors and tank setup with something that has instant and always-on pressure. Now, that also means that when the tank runs out, you're out of air—and potentially out of luck if you find yourself on the side of the road. The other problem? Well, if you've ever driven on a freeway and seen a truck with a diamond-shaped sign on the back that reads "Compressed Gas," you know that having something like that in your car or truck is dangerous. Getting into an accident could knock off the regulator. That turns the bottle into a missile that's aimed to go

The huge green bottles with the flames are compressed air tanks, and the regulator is shown at the top of the one on the left. Whenever the owner of this truck wants speed, he swaps out a few connections and goes to town.

out (not up), causing serious harm to you, bystanders, and your ride in the process. Photos exist of vehicles that have been the victims of exploded bottles, and they're not pretty.

So, can you do this type of setup? Sure, but it should only be used on show vehicles that don't see the road. Driving something like this is reckless and likely illegal in your area. Really, you're putting a loaded missile in the back of your vehicle, and no one wants that.

However, if you want a compromise, you have options. There are people who own hoppers that have essentially two setups. One is with standard-sized lines that run to a traditional tank and compressor setup. Then, there's another set that tees into the first, which is using the high-strength stuff. With the right plumbing and use of check valves, you could have two very interesting setups in one vehicle. It'd be expensive and not very practical, but you'd be able to hop your ride when you wanted.

Again, this isn't a recommended setup, but this book would be missing something if it wasn't mentioned. It is something you'll see out there in the wild, although it's far less common than it used to be.

Although this is a huge amount of fittings, it's also a good example of the kind of organization you want in your shop. After all, you're going to be using a lot of these little guys, and it'll help if you know where they are.

Fittings

No matter which type of air setup you choose, you need fittings. They're the way to connect two components of different types. When running an air line from a valve to an airbag, you need fittings to make the transition from national pipe taper (NPT) on the fitting to push to connect (PTC) for the air line to possibly a compression fitting and NPT on the airbag. That's just one scenario.

Fortunately (or unfortunately, depending on your perspective), there are many options. Some decisions will be based on aesthetics: chrome versus brass, plastic versus metal, etc. Others will be based on what you're connecting and how you want that connection made. You have many decisions to make, but there's a good place to start and that's with the materials used to make the fittings.

Materials

Every fitting has one or a combination of materials that make up the piece itself. Some are all metal. Others are metal and plastic, while another group is all plastic. What you select and where you put them makes a difference in the overall performance and longevity of the system.

Plastic fittings have their place. If you're running a line into the back of an air gauge, or you're placing the part in a low-heat environment, plastic fittings work well. Really, even in hotter spots (such as a trunk in the summer) you'll be fine with a plastic fitting. However, if it's in the engine bay, steer clear. Similarly, if you live in a hotter environment like the Southwestern United States, plastic fittings won't last that long. Years? Sure. However, they break down like everything made from plastic in those parts of the country, and when they do, the system will leak.

This fitting has a brass base and plastic PTC fitting. Is it the right one for your build? Well, that depends.

From a longevity perspective, metal fittings are preferred. (Some fittings have metal bases but plastic

inserts.) Brass, stainless steel, steel, and aluminum fittings are available, and they'll all work better than plastic if you want something that'll last a long time. However, not all metals are the same. Aluminum and brass are softer than steel and stainless steel. Sometimes, if a lower-quality metal fitting is used, the threads may not line up perfectly, which causes a leak. Also, if you're trying to connect two dissimilar metal fittings (for example: brass and stainless steel), you can easily strip out the softer one with the other or gall up the threads.

So, which type of fitting should you choose? It depends on the application and the location of the fitting. However, when in doubt, use one that's made by a reputable company (such as Parker, for example, which you can find at Grainger .com), and you'll be in good shape.

There's also one big thing on which to base all decisions moving forward: do you want D.O.T. or non-D.O.T. fittings?

All D.O.T. fittings will have "D.O.T." stamped on the side. It's a federal requirement. If you buy fittings that say they're D.O.T. approved and they don't have this stamp, chances are good that they're fraudulent.

This is a disassembled D.O.T. PTC fitting. Notice that tube in the middle? It's what makes it a D.O.T. fitting.

D.O.T. versus Non-D.O.T. Fittings

The short answer to the question is easy: the U.S. Department of Transportation (or DOT, as you'll often find it listed online without the proper periods) has safety standards for any fitting that is used in an air brake system, such as those on a semi-truck. These are held to a higher standard than traditional fittings and air lines and have certain fail-safes in place to ensure that things don't go south for the wrong reason.

Of course, the longer answer is a bit more complicated.

When it comes to any line that connects to a fitting, the first sign that it's D.O.T. approved is on the side of the fitting itself. There is a "D.O.T." stamp in an obvious place. The second indication is inside. If you peer down into the area where the air line goes, there is a sleeve. That tube support would sit inside an air line, providing crush resistance if the line was bent or kinked. There are other regulations for tanks and lines as well, but to be concise, if you want your air system to have all the same components that you'd find in a semitruck's air brake system, use D.O.T. fittings.

This brings up the other question: do you really need D.O.T. fittings?

Not necessarily. If you're buying quality fittings and plan the air line routes carefully, then you could get away with not running D.O.T. fittings at all. In fact, there are some shops that sell the European equivalent of D.O.T., and they've never had issues. The argument could be made that D.O.T. fittings are nice but not a requirement for your air system.

Of course, you also risk thinking that you're buying quality fittings, but it turns out that they're garbage. Or, it could be that your air line isn't as nicely run as you thought, and there are a few kinks here and there. There could be any number of other reasons that could come up to change your situation.

So, in the end it's up to you. There's nothing wrong with running a non-D.O.T. approved fitting, and it could work just fine, and it's not like D.O.T. fittings can't fail because that can happen too. It's a matter of whether or not you want that extra

assurance. There's no wrong answer here when it comes to fittings. It's your personal preference.

PTC Fittings

PTC fittings are a popular type for connecting air line to another item. However, to understand it, you need to see one that has been taken apart.

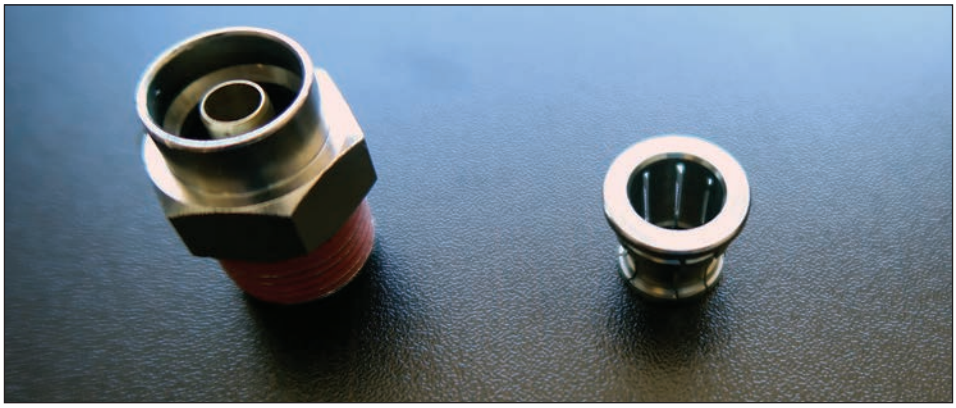
PTC fittings are very convenient to use, and as such, they are used in various air systems mostly because they're reusable. Let's say that you run an air line from the tank to a valve and you use a PTC fitting on both ends. Then, you change your mind and decide that the route you chose for the lines is too treacherous, so you rerun it. Do you need to replace those fittings now? No. Just push in the end of the PTC fitting to release the collet and pull the air line out. It's easy.

This is a PTC fitting seen from the side. The groove on the right-hand side is where the air line goes.

The catch here is that different fittings have different qualities. Some fittings have plastic PTC ends and others have stainless steel or brass ends. Some valve manifolds even have plastic fittings pressed in place, and you can't change them. So, which is better, plastic or metal? Most of the time it comes down to personal opinion. However, plastic will break down faster over time (because of exposure to heat) than metals, so keep that in mind.

The other issue is leaking. Some PTC fittings leak because the collet isn't holding the line snug enough or the line isn't pressed tightly against the seal to keep things in place. Also, if there's any wiggle room between the line and the seal or if vibrations cause the line to move, that seal can leak too.

The bottom line is that PTC fittings offer flexibility and ease of use, and they're widely available. You might be completely leak-free, or there could be issues. Just weigh the good with the bad before starting, and make the decision from there.



If the fitting is taken apart, you'll see that air line insertion point, and right underneath it is a piece called the collet. When you push the air line into the fitting, it moves past the collet and sits against a rubber O-ring. Once the line is pressurized, the collet keeps the line solidly connected and won't allow it to pull out.

Compression Fittings

Have you ever replaced the 1/4- or multi-turn angle valve on a toilet or under a sink? The basic idea is that there is a piece of bare copper pipe or cross-linked polyethylene (PEX) tubing coming out of the wall. You need to put a valve there to feed either the faucet or the toilet, and that seal needs to be tight. The fix? A compression fitting. That's what we're working with here too.

These are the basic components of a compression fitting. There's the nut on the top, the sleeve in the middle, and the fitting itself with the insert on the bottom.

Here's how everything looks from an exploded perspective when you put some 1/2-inch hose in the mix. The line goes through the nut and sleeve and then over the insert. Once it is tightened down, the sleeve compresses, locking the fitting tight.

Compression fittings are different than PTCs. There are three components: a nut, a sleeve, and the fitting itself. To assemble one, slide the air line through the nut, then the sleeve, then into the fitting. When the nut is tightened, the sleeve compresses, which seals the connection tight.

The advantage here is that you don't have to worry about your air line going anywhere. They're considered stronger than some PTC connections (depending on the quality of the PTC fitting), and they're easy to install.

However, that's where the convenience ends. The big problem with compression fittings is that they're one-time use only. Once that sleeve is crushed it's done, and it's not easy to remove, either. The only option is to cut the line off before the sleeve, and that may not leave you enough room to work with, depending on the way you arranged things. Think about that when you decide between compression and PTC fittings.

So, why would anyone use compression fittings over PTC for connecting air lines? The security of the lines is probably the main reason, and some just may not like worrying about PTCs. However, for lots of people, the one-time-use situation is a dealbreaker. It's also why many of the major valve manufacturers include PTC fittings on their own products.

It's often going to come down to a case-by-case basis. If you prefer the look and installation of compression fittings and you're not worried about having to replace them anytime soon, use them. As long as the air lines are solid and not leaking air, you'll be fine.

NPT Fittings

NPT describes how the threads themselves work. If you look at them up close, you'll notice that there's a taper to the threading itself that is different from the straight threads on the average bolt or nut. By having a taper, the threads eventually tighten against each other, making a theoretically tighter seal than with a straight thread pitch.

The problem is that it's not actually the case in systems that hold more than 60 psi. As a result, you use thread sealant on all NPT fittings, which is discussed more later

This is a D.O.T. fitting that's PTC on the right side and NPT on the left side. This fitting has orange thread sealant on the left, and some fittings come with it preinstalled.

Assembling Compression Fittings

The process of assembling compression fittings is pretty straightforward, but again, it's a one-time deal. That said, some people find it confusing, so here's a quick course in how it works.

The process begins by sliding the nut over the end of the cut air line and then the compression sleeve over that.

Then, the air line goes onto the fitting, and it's tightened in place.

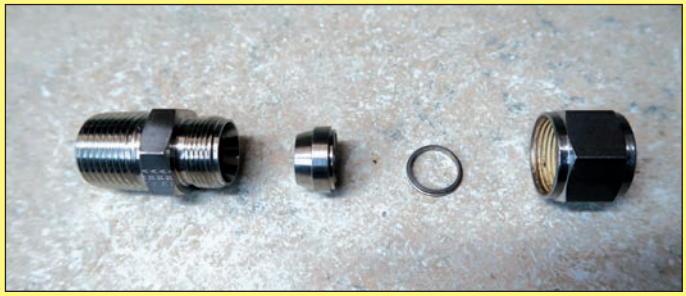
Swagelok and Other Compression Fittings for Hard Lines

When you're putting together your airbag setup, something you'll debate is if you should run soft lines or hard lines. Further on in this chapter you'll receive more details on both, but if you decide to go with hard lines, you have to decide if you want to flare your fittings, install them with custom tools, or buy more expensive fittings.

In the case of the latter, you're looking at Swagelok fittings. There are a few similar options (for example, Gyrolok), but the idea is that you don't need to flare the tubing ends to install them into the fitting. Instead, they use special compression sleeves on the inside to tighten the seal.

These fittings are not cheap, but if you're going to hard line your setup, they make your life a lot easier.

These Hoke Gyrolok fittings work just like Swageloks, but they're a bit more affordable.



Inside each fitting are two compression sleeves. When used in the sequence shown, they can tighten down the line to the point that it'll be leak free.

in this chapter. For now, just know that either Teflon tape or Loctite 545/565 is your friend when using NPT fittings.

There are many different types of fittings out there, and they come in a lot of different shapes and sizes. You're going to use a lot of them in your build, and many will be NPT. Why? It's the best way to connect two fittings without the use of a separate line. You also might need one as a reducer to shrink the size of the necessary thread or to couple two air line fittings together.

Sealing Fittings

Thread sealant is an important part of the build process. It helps lock two connecting threads together,

This is an NPT reducer bushing, which, in this case, is 1/2 to 1/8 inch. You'd use this if you wanted to put one end in a cross and run an 1/8-inch PTC fitting for an air gauge or something similar.

This is an NPT female fitting, which means it has female NPT threads. It's called an elbow because of its 90-degree angle.

These are called cross fittings, and they are all female NPTs.

This is a weird-looking fitting. It's an NPT muffler, and it's designed to go into the end of a dump valve. This will slow down and quiet the air exiting the valve, which is nice if you want to either slow down your drops or tone down the noise.

This is a straight NPT threaded cylinder, and it's called a close nipple. If you see the same thing with a wrench end in the middle, that is a hex nipple.

If there is an extra hole in a tank that you need to plug, you'd use this fitting, which is the appropriately named NPT plug.

This is a branch T. If it was all the same end, it would just be a T-fitting, but the NPT base here makes it a branch T (If the NPT or dissimilar end was on one of the opposing ends of the T, it would be called a street T).

creating an air-tight bond in the process. It's always a one-time use thing because once you loosen the threads, that bond is gone. But hey, sealant isn't expensive, and it's good insurance against leaks.

Of course, there are many various threads that you'll encounter. NPT threads come to mind, as do those on compression fittings and even some AN fittings that might sneak their way into your life in other ways. Which ones do you seal?

It's pretty simple: You only seal NPT fittings. In a strange twist, sealing any other type of fitting with a thread sealant will actually *cause* it to leak, which is obviously the wrong thing to do. So, if you want a leak-free setup, use sealant only on NPT fittings.

So, what do you use to seal NPT threads? Either use Teflon tape/sealant or Loctite 545/565.

Teflon tape is a common household item if you do any kind of home repair, and it's used for plumbing in the same type of scenario you'd use for working under your sink. If you've done any kind of work around pipes in your house, you've probably used it before. It's a thin material that's just like tape in application, you just have to install it in a certain fashion.

Another option is liquid Teflon, which works the same way as Teflon tape but in a viscous application. Apply some onto the threads, and

NPT Fittings and Leaks

At this point, you know that NPT fittings have a tapered connection with the theory being that two NPT fittings tighten against each other to create a tight seal. That does happen, but you also need some kind of sealant to complete the bond, such as Loctite 545 or Teflon tape/paste. Without one of those, you're guaranteed to leak.

The thing is, you might be guaranteed to leak anyway, depending on what you're doing.

If you're putting together two different kinds of metals, one is probably stronger than the other. So, if you're turning a brass fitting into a steel tank, the brass is softer and could distort while you're tightening it in place. Also, you could have two fittings that are made of the same material, but because you tighten them so hard, they actually stretch the threads. This is something that happens with engine bolts all the time, and you have to consider it with your fittings too.

To complicate things further, all the connections between two objects that need to be solid-mounted together use NPT fittings: valve to valve, pressure switch and gauge lead to tank. Also, if every NPT fitting has the possibility to leak, then it stands to reason that the more NPT connections you have, the risk of having leaks is higher.

This doesn't have to derail your process, and you can use NPT fittings if you're installing them properly. However, know that if you don't (or even if you do), you can't just break them apart and reuse them because they may have stretched. Try to minimize the number of connections in your system, always make sure to use the proper sealant, and if you have a leak, check the NPT connections first.